5.2.2 SCREENING OF TREATMENT TECHNOLOGIES

The National Oil and Hazardous Substances Contingency Plan (NCP) states that a reasonable number of alternatives must be developed for remedial action activities. EPA currently considers a range of treatment levels when evaluating alternatives. In this case the applicable technologies are all capable of operating throughout the treatment range. Therefore, the initial screening stages evaluated various technologies, using cleanup to the State Action Level or MCL for cost comparison purposes.

The following five methods were considered for treating the extracted groundwater:

Aeration
Granular Activated Carbon (GAC)
Aeration Combined with Vapor-Phase GAC
Selective Resin Adsorption
Ultraviolet Irradiation/Ozonation

Of these five, two treatment methods were rejected for reasons discussed below, and three treatment methods became components of the alternatives developed for detailed evaluation (see Section 5.3)

The selective resin adsorption treatment method was eliminated from consideration on the basis of cost and effectiveness. This is a mechanism by which contaminants are removed from water by adsorption on synthetic resin, which the water passes over. The cost of the resin is orders of magnitude greater than the cost for carbon, which is used in a similar method (GAC), discussed in detail in Section 5.3.3. Additionally, the disposal of spent resin is expensive. Spent resin must be transported to and disposed of in an approved hazardous-waste disposal facility, at a rate of several dollars per pound. Also, the applicability of this technique to volatile-organics removal has not been demonstrated; the process is presently limited to small-scale treatment of electronic circuit board processing water and pharmaceutical manufacturing. Because it is an unproven technology, it was not considered suitable for this operable unit.

The ultraviolet irradiation/ozonation treatment technique was also rejected due to expense and effectiveness. In this method, volatile organic compounds in the pumped groundwater are broken down by ozonation. The efficiency of the process is enhanced by irradiation of the influent with ultraviolet light. Due to the corrosive nature of the gas, much of the process hardware must be ozone resistant, necessitating high capital costs. Like selective resin adsorption, this technology is unproven for this application. Ultraviolet irradiation/ozonation is currently in use for disinfecting water, but it is not known whether the method is effective in oxidizing TCE and PCE. Since it would require a lengthy pilot program, the technique is not appropriate for a Fast-Track action.

5.3 DETAILED ALTERNATIVE EVALUATION

The three alternatives that remained for consideration were subjected to detailed evaluation. These alternatives are listed below:

- Extraction and Treatment by Aeration
- Extraction and Treatment by Granular Activated Carbon (GAC)
- Extraction and Treatment by Aeration Combined with Vapor-Phase GAC

This section describes each of the alternatives and presents an evaluation of each on the basis of cost, technical concerns, public health concerns, and environmental impacts. Because extraction of the groundwater and conveyance to the treatment plant is a component of each alternative, and because this component constitutes the majority of the expense for each alternative, the extraction and conveyance plan and costs are presented first.

5.3.1 EXTRACTION AND GROUNDWATER CONVEYANCE

Computer-aided modeling of the hydrogeology of the North Hollywood area indicated that eight extraction wells would be sufficient to create a drawdown zone toward which the contaminated groundwater would flow, thus preventing offsite migration of the plumes. The modeling used a transmissivity value of 20,000 gpd/ft., based on an aquifer test performed at North Hollywood Well No. 5, and a storage coefficient of 0.03, assuming unconfined aquifer conditions. Transmissivity and the storage coefficient were assumed to be constant over the entire well field. The analysis determined the drawdown zone that would be created after each of the eight extraction wells was pumped at a rate of 300 gallons per minute over a period of 180 days. For several sets of conditions and several arrangements of pumping wells, the model computed the groundwater flow gradient that would result from the combined effects of pumping-induced and natural groundwater flow gradients.

The modeling revealed that the exact location of each of the eight wells was unimportant as long as they are spaced somewhat evenly across the contaminated area and arranged approximately perpendicular to regional groundwater flow, which is toward the southeast. An arrangement was then developed whereby the wells could be situated within an existing DWP powerline right-of-way.

Costs presented for the wells include drilling and casing, as well as equipping each with a submersible pump capable of providing the necessary lift to transport 250 gallons per minute to the surface and through the collection pipeline to the point of treatment. The array of wells will produce a total of 2,000 gallons per minute and the combined system of pumps will lift the groundwater a total of about 400 feet, including pipe friction losses.

Once extracted, the groundwater will be conveyed to the treatment site. On the basis of hydraulic and routing studies, it was determined that a collection pipeline consisting of approximately 11,000 feet of 12-inch steel pipe constructed through portions of DWP properties and under dedicated streets would be adequate.

The costs of building, operating, and maintaining the extraction and conveyance system are provided below. Also, the present worth of extraction and conveyance is presented for comparison with those of the three final alternatives on Table 5-1.

Capital Costs for Extraction and Conveyance

Extraction Wells	$ 300,000
Inlet Line	1,091,044
Outlet Line	72,202
Subtotal	$ 1,463,246
Contingencies (20%)	292,649
TOTAL	$ 1,755,895
Annualized Capital Cost (15 yr., 10%)	$ 230,854

Continued Operations Costs

Annual	
Energy	$ 151,300
Labor	$ 5,000
Contingencies (30%)	$ -0-
TOTAL	$ 156,300
Present Worth (15 yr, 10%)	$ 1,188,830

Total Cost

Annual	$ 387,154
Per 1000 gallons	$ 0,368
Present Worth	$ 2,944,725

TABLE 5-1

COST SUMMARY OF FINAL ALTERNATIVES

	Capital Cost ($)	O&M Present [1] Worth ($)	Total Present [1] Worth ($)
Extraction and Conveyance Only[4]	1,755,895	1,188,830	2,944,725
Aeration Alternative[2]	277,000	419,856	696,856
GAC Alternatives[2,3]	493,000	2,745,795	3,238,795
Aeration/GAC Alternative[2,3]	437,000	1,095,275	1,532,275

1 Present Worth calculations are based on 15-Year annualization, discounted at 10%; all costs are in 1986 dollars. The fifteen year time period, or the useful life of the facility, was estimated from a review of literature available primarily for facilities somewhat larger than this one. Several researchers report that 20 years may be reasonable and assumed a low amortization return rate (7.8%). As a compromise, an estimated life of 15 years was used with a higher amortization rate (10%) for the proposed facility and the facility present worth was calculated accordingly.

2 Values given for alternatives are the high-side estimates.

3 Costs for GAC alternatives assume virgin-carbon supply and disposal.

4 Total cost of remedy is obtained by adding extraction and conveyance cost to the cost of each alternative.

5.3.2 EVALUATION OF TREATMENT ALTERNATIVES

Extraction and Treatment by Aeration

This is a method whereby volatile organic compounds (VOCs) are removed from groundwater by volatilization at the air-water interface. The pumped groundwater is run through a vertical column containing a packing medium. The medium provides great surface area over which a countercurrent flow of air is introduced. The contaminant is transferred from the water to the air and subsequently removed. The efficiency of the process is dependent on the nature of the contaminant, its influent concentration, the rate of air flow, and the available surface area afforded by the packing material. For TCE and PCE, removal efficiencies can exceed 99 percent. Aeration is a proven method, commonly used for treating groundwater.

This alternative has two drawbacks with respect to public health and the environment. There is the possibility of low-level, long-term cancer risk due to the release of volatized contaminants into the air. This release of contaminants also contributes to air quality degradation.

The following costs correspond to a facility consisting of a single aeration column shell 12.0 feet in diameter and 48.0 feet in height, a packing depth of approximately 20.2 feet, column pad and supporting structure, 15-hp blower and influent pump, demister, dehumidifier, and related appurtenances. These costs were developed with the assumption of an extraction flow rate of 2,000 gallons per minute, treatment to State Action Levels (MCL's), and maximum expected influent TCE and PCE concentrations of 650 and 100 ppb, respectively. For comparison with the other two alternatives, capital costs and annual continued operations costs are provided that do not include extraction and conveyance. The total cost and present worth, however, refer to the entire system, including extraction, conveyance, and treatment.

	Low	High
Capital Costs		
Treatment Plant	$ 116,500	$ 247,000
Contingencies	10,000	30,000
TOTAL	126,500	277,000
Annual Continued Operation Cost (Treatment Plant)		
Power	8,200	8,200
Chemicals for biofouling and corrosion	37,000	37,000
Maintenance	5,000	10,000
TOTAL	50,200	55,200
Total Cost (Including Extraction and Conveyance)		
Annual	$ 453,985	$ 478,772
Per 1000 Gallons	0,432	0,455
Present Worth (15 yr., 10%) (including extraction and conveyance)		
	$3,453,050	$ 3,641,581

Extraction and Treatment by Granular Activated Carbon

In this alternative, contaminated groundwater is passed through a bed of granular activated carbon. Volatile organics are removed by direct adsorption onto the carbon particles. Removal efficiency of this treatment method exceeds 99 percent.

The spent carbon generated by this process must be either disposed of at an approved hazardous-waste facility or regenerated. Disposal of spent carbon is the only disadvantage of this alternative with respect to public health and the environment; regeneration of spent carbon would minimize the impact of the process upon public health and the environment.

*$230,854 + $156,300 + [($126,500 x .13147 $CR^{I = 10\%)}_{N = 15\%)}$ = $16,631]
+ 50,200 = $453,985

**$230,854 + $156,300 + [($277,000 x .13147) = $36,417] + $55,200
= $478,772

The following costs correspond to a facility consisting of two fixed contactors having a combined volume of approximately 3,500 cubic feet, along with appurtenant electrical, mechanical and civil elements. Costs for continued operations were developed for two scenarios: the first assumed the use of virgin carbon and its disposal, the second involves offsite carbon regeneration. These costs were developed with the assumption of an extraction flow rate of 2,000 gallons per minute, treatment to State Action Levels and federal maximum contaminant levels. For comparison with the other two alternatives, capital costs and annual continued operations costs are provided that do not include extraction and conveyance. The total cost and present worth, however, refer to the entire system, including extraction, conveyance, and treatment.

	Low	High
Capital Costs		
Treatment Plant	$ 305,000	$ 425,000
Pilot Study	-0-	10,000
Contingencies	20,000	58,000
TOTAL	325,000	493,000

Annual Continued Operation Cost (Treatment Plant)

I Virgin Carbon and Disposal

	Low	High
Power	-0-	-0-
Carbon	178,500	210,000
Disposal	100,000	126,000
Maintenance	5,000	20,000
TOTAL	283,500	356,000

II Regenerated Carbon

	Low	High
Power	-0-	-0-
Carbon	94,500	94,500
10% Make Up	9,450	9,450
Maintenance	5,000	20,000
TOTAL	108,950	123,950

Total Cost (Including Extraction and Conveyance)

Annual	$ 713,383*	$ 807,971 (I)
Per 1000 Gallons	0.679	0,769
*$230,854 +156,300 + 42,728 (325,000 x .13147) +203,500 $713,382	$ 538,833 0.513	$ 575,921 (II) 0.548

Present Worth (15 yr., 10%)
(including extraction and conveyance)

I Virgin Carbon and Disposal

$ 5,426,049	$ 6,145,489

II Regenerated Carbon

$ 4,098,407	$ 4,380,499

Extraction and Treatment by Aeration Combined with Vapor-Phase GAC

This alternative is exactly the same as the aeration alternative, except that instead of releasing contaminants directly to the atmosphere, they are removed from the aeration-tower gases by vapor-phase GAC. The aeration tower gases, comprising mainly water vapor and contaminant, are dehumidified and then directed to a gas-phase granular activated carbon unit for final processing. By this means, the two public health and environmental concerns related to the aeration alternative are eliminated; the public is not exposed to possible carcinogens in the atmosphere and air quality is not degraded.

Because of the use of granular activated carbon, this alternative involves the disposal of spent carbon, which is a concern with respect to public health and the environment. As was discussed above, the impact of the GAC process upon public health and the environment would be minimized by regeneration of spent carbon. Vapor-phase GAC differs from the liquid-phase GAC process evaluated above in being more efficient. The method, therefore, uses less carbon and could result in the generation of a smaller volume of spent carbon.

Removal efficiencies of the aeration treatment method can exceed 99 percent for TCE and PCE. Additionally, the efficiency of the vapor-phase GAC in removing contaminants from the aeration-tower gases is greater than 99 percent. The following costs correspond to a facility identical to that of the aeration alternative with the single exception that a GAC unit is added to the aeration column off-gas to prevent venting of contaminants to the atmosphere. Costs for continued operations were developed for two scenarios: the first assumes the use of virgin carbon and its disposal, the second involves off-site carbon regeneration. These costs were developed with the assumption of an extraction flow rate of 2,000 gallons per minute, treatment to State Action Levels, and federal Maximum Contaminant Levels. For comparison with the other two alternatives, capital costs and annual continued operations costs are provided that do not include extraction and conveyance. The total cost and present worth, however, refer to the entire system, including extraction, conveyance, and treatment.

	Low	High
Capital Costs		
Aeration Costs	$ 126,500	$ 277,000
Carbon Contactors	100,000	120,000
Pilot Study	-0-	10,000
Subtotal	226,500	407,000
Contingencies	10,000	30,000
TOTAL	236,500	437,000

Annual Continued Operation Cost (Treatment Plant)

I Virgin Carbon and Disposal

Carbon	40,000	45,000
Pump Power	-0-	-0-
Disposal	15,000	21,000
Energy	8,500	8,500
Carbon Handling	-0-	17,500
Maintenance	5,000	10,000
Chemicals	37,000	37,000
TOTAL	105,500	139,000

II Regenerated Carbon

Pump Power	-0-	-0-
Carbon	17,000	45,000
Make up Losses	4,500	7,000
Freight	7,000	7,500
Energy	8,500	8,500
Carbon Handling	-0-	17,500
Maintenance	5,000	10,000
Chemicals	37,000	37,000
TOTAL	79,000	132,500

	$ 497,248	$ 577,108	(II)
	0.473	0.549	

Total Cost (Including Extraction and Conveyance)

Annual	$ 523,748	$ 583,608	(I)
Per 1000 Gallons	0.498	0.555	

Present Worth (15 yr., 10%)
(including extraction and conveyance)

I Virgin Carbon and Disposal

$ 3,983,666	$ 4,438,970

II Regenerated Carbon

$ 3,782,105	$ 4,389,531

6.0 COMMUNITY RELATIONS

In December, 1986 EPA and DWP held a community meeting on the OUFS report. The meeting went well, panel members from LADWP and EPA addressed community questions and several community members verbally delivered prepared comments. Approximately 15 residents attended plus a number of agency and media representatives.

A Community Work Group (CWG) was formed that is comprised of residents, public interest groups, business and elected officials. The CWG meets regularly on a bimonthly basis to discuss issues associated with the San Fernando Valley Superfund sites.

7.0 CONSISTENCY WITH OTHER ENVIRONMENTAL LAWS

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires that remedies selected meet or exceed all applicable or relevant and appropriate requirements of federal and State environmental laws.

The following is a discussion of the requirements that are applicable or relevant and appropriate to this action and how they will be met by each remedial alternative.

Safe Drinking Water Act

Waters of the United States as defined in 40 CFR 230, Subpart E, does not exist in the North Hollywood Burbank Areas.

The applicable Federal environmental statute is the Safe Drinking Water Act. Under this law, EPA established drinking water regulations for contaminants through a two-step process. First, EPA promulgates health-based levels, termed Maximum Contaminant Level Goals (MCLG, previously called Recommended Maximum Contaminant Levels, or RMCL) under the Safe Drinking Water Act Amendment of 1986. MCLGs are set at levels at which no adverse public health effects would occur and are set at zero for known or probable carcinogens, since there is no safe level of exposure to a carcinogen. Because MCLGs are unenforceable health goals, public water supply systems are not required to meet them in water they deliver to their customer. EPA then establishes Maximum Contaminant Levels (MCL) taking into account the availability, cost and technical feasibility of water treatment technologies that can be used to reduce the concentrations of the contaminant in public water supplies. MCLs are enforceable standards that must be met by public supply systems.

The State of California has developed State Action Levels which in most cases parallel EPA's MCL's and MCLG's. For the contaminants in question, the following levels apply:

Contaminant	MCLG	MCL	SAL
TCE	0	5 ppb	5 ppb
PCE	0	--	4 ppb

Section 121(d) of CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), requires that Fund-financed remedial actions comply with requirements or standards under Federal and State environmental laws. The requirements that must be complied with are those that are applicable or relevant and appropriate (ARAR) to the contaminants at the site. It has been determined that the MCL's for TCE and PCE are applicable to this remedial action. This ARAR is a chemical-specific requirement. An MCL is an appropriate standard because it is the legally enforceable standard for drinking water, which is set as close to the health-based MCLGs as feasible. The MCL of 5 ppb for TCE and State Action Level (SAL) of 4 ppb for PCE is the appropriate cleanup level for the San Fernando Valley Ground Water Basin. The agency believes that MCLs are protective of public health. As the legally enforceable standards under the Safe Drinking Water Act, the MCLs represent the level of water quality that EPA believes is acceptable for Americans to consume every day from public drinking water supplies.

All of the final remedies were designed to meet the MCL for TCE and the State Action Levels for TCE and PCE. This will ensure that the treatment plant does not cause a violation of any standards at the tap.

Resource Conservation and Recovery Act (RCRA)

This legislation relates to the alternatives only as regards the disposal of spent carbon, generated by the GAC process, at a RCRA Class I disposal facility. Spent carbon will be disposed of at an appropriate facility. Pursuant to CERCLA section 104(C)(3)(B), the State is required to assure the availability of a hazardous waste facility. The DWP, in its invitation for bids for the remedial action, will require respondents to provide adequate capacity for waste disposal at a facility that meets all applicable requirements of the Resource Conservation and Recovery Act and that is consistent with EPA's off-site disposal policy. A RCRA compliance inspection shall be completed by EPA or the State for the waste facility within six (6) months prior to the receipt of the designated wastes from the site. The EPA Regional office in which the facility is located will review the results of the compliance inspection and other available information to determine if the facility meets the criteria set forth by EPA.

Clean Air Act

In California, the authority for enforcing the standards established under the Clean Air Act has been delegated to the State. The program is administered by the South Coast Air Quality Management District (SCAQMD) in Los Angeles. DWP worked with the SCAQMD to develop alternatives that would comply with their regulations. The uncontrolled aeration facility alternative was found not to pose a significant health risk by the SCAQMD. However, due to overwhelming citizen concern over release of any additional air pollutants into the South Coast Air Basin , the recommended remedy includes air pollution control on the off-gases from the aeration facility.

The carbon air filtering units will provide additional protection of human health and the environment by reducing TCE and PCE air emissions. Given the concentrations of contaminants in the ground water, it is estimated that 16 lbs/day of TCE and 2.5 lbs/day of PCE would be emitted into the air without carbon air filtering units. With the addition of carbon air filtering units, it is estimated that there will be 100 percent capture of the contaminants in the vapor phase. DWP's permit with SCAQMD requires a 90 percent removal efficiency for air emissions.

This technology is consistent with EPA's Office of Air Toxics policy of requiring carbon adsorption emission controls on all aeration facilities. This technology is also supported by SARA which expresses a preference for treatment that significantly and permanently reduces the volume, toxicity, or mobility of the waste to the maximum extent possible.

8.0 RECOMMENDED ALTERNATIVE

SARA, in addition to Section 300.68(i) of the National Contingency Plan (40 CFR Part 300), defines the appropriate extent of remedial action. Remedies must be protective of human health and the environment. Remedies that attain or exceed applicable or relevant and appropriate requirements (ARARs) are protective. The selected remedy must also be cost-effective; that is, it must confer a level of protection that cannot be achieved by less costly alternatives. SARA expresses a preference for treatment that permanently and significantly reduces volume, toxicity or mobility to the maximum extent practicable.

EPA has determined that the cost-effective interim remedy is extraction and treatment by aeration combined with vapor-phase carbon adsorption. All three alternatives that were considered are capable of attaining the ARARs (MCL and State Action Levels) and protect human health. All three alternatives are technically implementable and currently available for installation. The long-term risk is highest for the aeration only facility. This plus overwhelming public concern over air emissions caused EPA to select the aeration with carbon adsorption on the off-gas alternative. This alternative, although more costly than aeration by approximately $835,419 (see Table 8.1), provides an additional level of protection that is not achieved by the aeration only alternative. The remedy reduces the mobility of the contaminants in that air contaminants are adsorbed by the carbon filter.

As discussed in Section 7.0 above, the recommended cleanup level is the MCL for TCE and the State Action Level for PCE. These levels were selected because they are attainable, and they provide a level of protection of public health which is equivalent to that required in all public drinking water systems.

Once the remedy is operational, it is estimated that 3200 acre/feet/year of groundwater will be treated and consumed. The value of the treated water is estimated to be $300,000/year.

TABLE 8.1

COST SUMMARY OF FINAL ALTERNATIVES

	Capitol Cost ($)	Continued Operations Present Worth ($)	Total Present Worth ($)
Aeration Alternative	2,032,895	1,608,686	3,641,581
GAC Alternative	2,248,895	3,934,625	6,183,520
Aeration/GAC Alternative	2,192,895	2,284,105	4,477,000

9.0 CONTINUED OPERATIONS

The proposed groundwater treatment facility, will be under automatic operation 24 hours a day. Contingencies, such as blower failure or excessive aeration column head loss have been provided for in the project design. Groundwater extraction pumps will automatically shut down if the aeration column floods or if there is a sudden loss of pressure in the collector line due to a leak or break. Maintenance of the facility will consist of scheduled checks of the aeration column and chlorine and sodium hexametaphosphate injection equipment, which will include periodic maintenance of all moving equipment and parts on an as-needed basis. The granular activated carbon emissions control contactors should require only minimal maintenance; however, the air emissions from the contactors will be monitored on a regular basis to ensure that aeration contaminants are not emitted to the atmosphere.

The aeration facility will be constructed by the DWP under a cooperative agrement with EPA. Before entering into the cooperative agreement, EPA will ensure that a 3-party agreement between EPA, the California Department of Health Services (DHS), and DWP is signed which delineates each agency's role. As required by CERCLA/SARA, DHS will assure 10% of the construction funds and 10% of the continued operations costs. Although the State is responsible for the cost share for continued operations, the political subdivision, DWP, agrees to provide the 10% DHS cost share. DWP and the State must assure full responsibility for operations and maintenance.